**Zero Energy Cooling Chamber (ZECC) for Vegetable Storage and Preservation**

**Description of the Technology**

The Zero Energy Cooling Chamber (ZECC), kiln-fired brick chamber built and operates based on the direct evaporative cooling principle. It is a double brick-wall structure; the cavity is filled with sand, and walls of the chamber are soaked with water (Roy, 2007). With effective evaporative cooling, temperatures between 10 - 15 oC and relative humidity of about 95% (Roy, 2007; MAIB, 2011) can be achieved in the chamber and that can increase the shelf life and retain quality of perishables crops.

**Design and Construction of ZECC**

Use a clean (free from insects, predators such as rodents and reptiles, far from old or landfills in use) upland field or site having a nearby source of water supply. Level the ground and measure or mark out the position for the chamber. Arrange the bricks on the ground measured or marked out first, followed by the arrangement of bricks for the inner and outer walls. For example, dimensions such as (L x W x H) of the outer and inner brick walls 170 cm x 170 cm x 60 cm and 160 cm x 160 cm x 60 cm with a cavity of 10 cm filled with sea sand respectively, can produce a ZECC (plate 1 and 2). **This estimate will give an area of and volume of** Thermal insulating materials made from plant materials such as straw mats and jute sacks are used to cover the chamber. A shed, roofed with thatch is erected over the chamber to protect it from direct sun radiation and rainfall.



**Storage space**

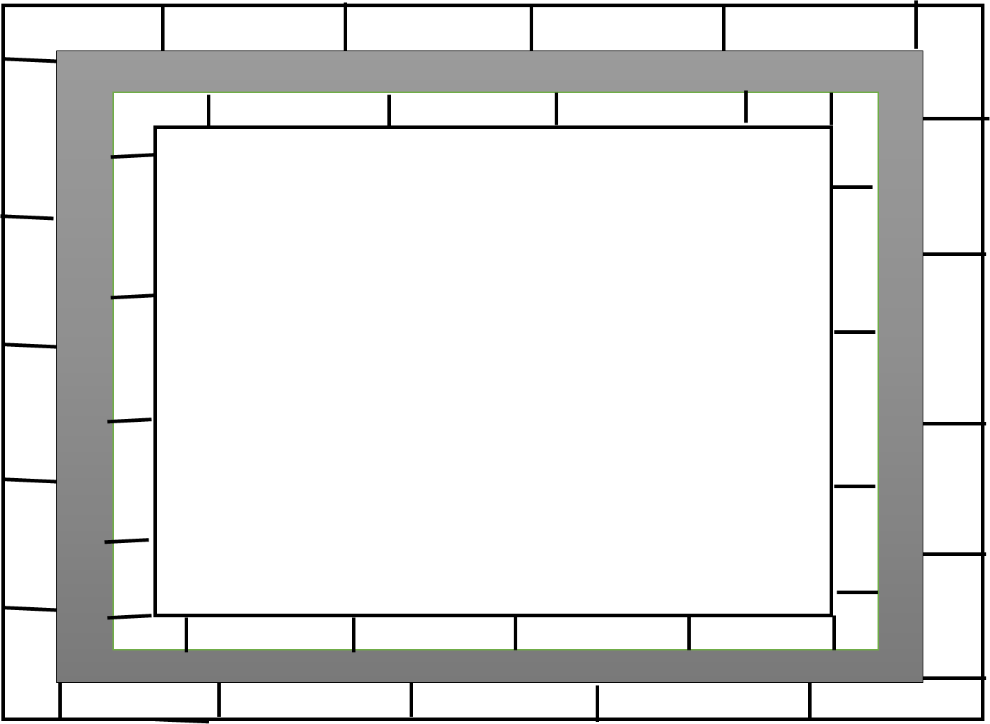
**Cavity between walls**

**Inner wall**

**Outer wall**

Plate 1: Pictorial description of ZECC

Plate 2: Diagram of ZECC



**170 cm**

**170 cm**

**Storage space**

**Inner wall**

**Outer wall**

**Cavity between the walls filled with sea sand**

**Key messages**

The technology reduces vegetable losses, enhances the shelf-life of vegetables, promotes even ripening in stored tomato fruits, and serves as a source of security for users during storage and marketing.

**Conditions that favour uptake**

The temperature in these areas is high and adversely affect vegetable production and marketing. Vegetable farming, however, continues to be a major activity and source of livelihood for farmers and traders. The ZECC reduces post-harvest loses during storage, preserves and enhances the shelf life of vegetables for marketing which will ultimately increase the disposal income of farmers and marketers. Against this backdrop, the ZECC technology is expected to receive favourable patronage among vegetable farmers, marketers and processors.

**Necessary ingredients for implementation**

Stakeholders’ involvement is key; identified stakeholders include Agricultural Extension Agents (AEAs) from the Ministry of Food and Agriculture, Farmer Base Organizations (FBOs), Farmer and Trader groups, and small and medium scale processors.

**Alignment with household resource endowments**

Apart from the kiln-fired bricks, all required materials can be locally assembled. When sited in homes, management practices such as water application/watering, security of vegetables, sorting of produce, and the elimination of predators such as rodents, termites can be easily carried out by household members.

**Adaptation possibilities**

The ZECC technology is highly adaptable to the agro-ecological environment in the Northern belt of Ghana, and to the psychological needs of farmers and marketers who make a living from vegetable production.

**Where was the Technology validated**

Under the auspices of WorldVeg and Africa Rising, studies have been conducted in selected locations in Northern (Bunglung in 2015; Doku in 2019 – 2021) and Upper East (Takoro and Nyangua in 2016; Nyangua 2019 - 2021) regions of Ghana. The activities involved hands-on training on the construction of chambers for farmers, experimentation of vegetable storage and physical evaluation after storage. Analysis of the nutritional qualities of the stored tomatoes was also undertaken. A stakeholder’s consultation workshop was organized in June 2021 to share results and strategize on the way forward, which developed a communique. The outcome was impactful and generally successful. Other training sessions also took place in Mali Koutiala and Bougouni in Mali.

**Potential benefit to user**

The advantages of this technology are,

1. does not require electricity or fuel power to operate,
2. materials required for construction such as bricks, sea sand, wooden poles, thatch/raffia and straw mats are locally available, and
3. provides storage, better ripening and preservation of perishables such as fruits and vegetables (plate 3).





**Things to worry about**

***Access:*** proximity to subsidized kiln-fired bricks for the construction of the chamber.

***Security***: protection for stored vegetables against theft and predators such as rodents,insects and reptiles.

**References**

1. Roy, S.K. (2007). On-farm storage technology can save energy and raise farm income. Amity Science, Technology & Innovation Foundation. Amity University Uttar Pradesh, Expressway, Sector-125, Noida
2. MAIB (My Agricultural Information Bank) (2011). Cold Chamber Storage for Fruits and Vegetables. Available at http://agriinfo.in/default.aspx?page=topic&superid=2&topicid=2060 Accessed: 19/03/2015.